MULTI-LEVEL FULFILLMENT CENTER FOR UNMANNED AERIAL VEHICLES

BACKGROUND

[0001] Fulfillment centers are typically large-volume single-floor warehouse buildings used to temporarily store items prior to shipment to customers. Often, due to their large footprint, these buildings are located on the outskirts of cities where space is available to accommodate these large buildings. These locations are not convenience for deliveries into cities where an ever-increasing number of people live. Thus, there is a growing need and desire to locate fulfillment centers within cities, such as in downtown districts and densely populated parts of the cities. By locating the fulfillment centers within the cities, items may be more quickly delivered to the growing population of people that live in the cities, as well as the large population of people who work in the cities.

[0002] Conventionally, items have been delivered from fulfillment centers by common carriers, which travel from the fulfillment centers located outside of the city into the cities to the customer's residence or designated delivery location. Smaller businesses, such as restaurants, sometimes use bicycle delivery and walking delivery of items to customers that are located near the business. More recently, additional types of deliveries have grown in popularity and feasibility, such as delivery by unmanned aerial vehicles (UAVs) and delivery by short-term hired ground vehicle drivers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The detailed description is described with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The same reference numbers in different figures indicate similar or identical items.

[0004] FIG. **1**A is an isometric view of an illustrative multi-level fulfillment center designed to accommodate landing and takeoff of unmanned aerial vehicles (UAVs).

[0005] FIG. **1**B is a side elevation view of a cross-section of the multi-level fulfillment center shown in FIG. **1**A.

[0006] FIG. **1**C is a side elevation view of a detailed view of an illustrative level of the multi-level fulfillment center **100** shown in FIG. **1**B

[0007] FIG. **2** is an isometric view of an illustrative multi-level fulfillment center having a hub and spoke profile as viewed from a top view. The hub and spoke profile increases external surface area usable to land and deploy UAVs from sides of the fulfillment center.

[0008] FIG. **3** is an isometric view of an illustrative multi-level fulfillment center having an exterior that converges toward the top of the fulfillment center. The converging exterior enables placement of landing and deployment surfaces about the exterior that have relatively clear airspace above each surface.

[0009] FIG. **4** is an isometric view of an illustrative multi-level fulfillment center having a top section that extends outward beyond a base section of the fulfillment center. The top section provides additional surface area for landing and deploying UAVs from a high elevation of the fulfillment center.

[0010] FIG. **5** is an isometric view of an illustrative multi-level fulfillment center having a vertical corridor to accommodate entrance and exit of unmanned aerial vehicles (UAVs).

[0011] FIG. **6**A is an isometric view of an illustrative multi-level fulfillment center having multiple vertical corridors to accommodate entrance and exit of UAVs.

[0012] FIG. **6**B is a side elevation view of a cross-section of the multi-level fulfillment center shown in FIG. **6**A.

[0013] FIG. **7** is a top plan view of an illustrative multi-level fulfillment center having multiple corridors, where some corridors are configured for deployment of UAVs while other corridors are configured to receive incoming UAVs.

[0014] FIG. **8**A is an isometric view of an illustrative multi-level fulfillment center designed to accommodate movement of UAVs pods about an exterior of the fulfillment center. The UAV pods are configured for landing and takeoff of UAVs and movement about the exterior of the fulfillment center.

[0015] FIG. **8**B is a detail view of an exterior of the fulfillment center shown in FIG. **8**A showing illustrative movement options for various moveable UAV platforms.

[0016] FIG. **8**C is a side elevation view of a cross section from FIG. **8**B of a moveable UAV platform coupled to the exterior of the fulfillment center.

[0017] FIGS. **8**D and **8**E show deployment of a UAV using a tilt action of the moveable UAV platform.

[0018] FIG. **9** is a flow diagram of illustrative operation of a fulfillment center that uses UAVs to perform at least some deliveries of items from the fulfillment center.

[0019] FIG. **10** is a flow diagram of additional illustrative operation of a fulfillment center that uses UAVs to perform at least some deliveries of items from the fulfillment center.

DETAILED DESCRIPTION

[0020] This disclosure is directed to multi-level (ML) fulfillment centers designed to accommodate landing and takeoff of unmanned aerial vehicles (UAVs). The fulfillment centers may be located in downtown districts and/or other densely populated urban areas. Unlike traditional fulfillment centers, the ML fulfillment centers may include many levels (i.e., stories, floors, etc.) as permitted under zoning regulations for respective areas. The fulfillment center may have one or more landing locations and one or more deployment locations to accommodate UAVs, which may delivery at least some of the items from the fulfillment center to locations associated with customers.

[0021] Freight (e.g., bulk merchandise, supplies, etc.) may be delivered to the fulfillment center using conventional ground transit, such as by semi-trailer and tractor. Freight may also be delivered using other modes of transit, such as by rail, air drop, maritime vessel, and/or other techniques that enable safe and reliable delivery of freight to the fulfillment center in accordance with local ordinances and customs.

[0022] The ML fulfillment centers may support traditional deliveries by common carriers that use ground vehicles to deliver items to customers. The fulfillment centers may also include a self-service space where customers can pick up items. The items may be temporarily stored in lockers or otherwise made available to customers for self-pick-up.

[0023] Like traditional fulfillment centers, the ML fulfillment centers may include shelves and other storage areas to